Lake Erie Workshop
SOLEC 2004
October 7, 2004
Number of Participants: 35

Physical Integrity of Lake Erie
Landscapes, Watersheds, and Hydrology

Physical Integrity - <u>Physical structure, connectivity, and processes</u> that "…maintain a balanced, integrated, and adaptive system capable of sustaining all components and interactions (structure and function) in an organized manner."

1. How has the physical integrity of Lake Erie been impaired?
   o Watersheds
   o Tributaries
   o Estuaries/River Mouths
   o Coastal Wetlands
   o Nearshore (<10 m water depth, <5 m in Western Basin)
   o Open Lake

-**Watershed** (reduced forest cover, restructuring of subsurface flows, altered flows, ground and surface water withdrawals, altered pathways)

-**Tributaries** (sedimentation, accelerated erosion, increased flows, temperature change/thermal effect, habitat alteration, channel morphology (instability, width/depth ratios), loss of connectivity (absolute and temporary), altered base flows, alter thermal regime, alter chemical regime)

-**Estuaries/river mouths** (altering substrate, raising temperature, increased stratification (thermal), increased turbidity (from channel dredging), changes in light regiment (transparency: from turbidity), alter of physical structure (substrate), alter lateral flow/connectivity, littoral sediment transport, deposition and erosion, altered substrates)

-**Coastal wetlands** (filtering, sediment trapping, inability to migrate landward (during higher water levels)) CONNECTIVITY

-**Nearshore** (littoral sediment transport, deposition and erosion, altered substrates, changes in water depth and changes in energy (wave energy), shoreline hardening (parallel), change in light regiment (increased transparency), loss of barrier systems (beaches, nearshore substrates and wetland implications), loss of sediment supply (coarser grain sediment))

-**Open lake** (plumes, change in substrate, delivery of water (time and flow rate) from tributaries/flow characteristics (which changes nutrient and contaminants loadings), physical dispersion, re-suspension, hypoxia, thermal stratification effects)

2. What are the stressors causing these impairments?
   o Landscape/Watersheds
   o Hydrology
   o Other

-**Watershed** (urban sprawl, land use change, agricultural activities, impervious surfaces, ground and surface water withdrawals/water use)

-**Tributaries** (dams and barriers, hydro-geomorphic alterations (e.g. channel straightening), levies and dykes, filling of flood plain, altered connectivity between groundwater and surface water (interactions), mining (sand extraction))
-**Estuaries/river mouths** (dredging of navigation channels (contaminant issues for dredging) (faster and warmer water), invasive exotic plant species (and other organisms e.g. zebra mussels), dredging, shoreline hardening and alteration, navigation structures)
-**Coastal wetlands** (exotics (esp. macrophytes), land use (esp. hardening, roads etc.),
-**Nearshore** (zebra mussels, re-suspended sediment, dams, shoreline altering, mining (sand extraction))
-Open **lake** (zebra mussels, sediment deposition (increased sediment loads), atmospheric deposition, respiration (zebra mussels), increased transparency in the open lake)

3. Over what spatial and temporal scales do these stressors act?

-Agriculture (decade)- urban
-Climate change (decade or longer)- global
-Navigation (seasonal or annual)- tributary
-Algal bloom (seasonal/annual)- tributary
-Storm events (broad or isolated)- basin

-Cumulative impacts→scaling up
-Climate change→scale down
*Need greater integration of scales

4. What key indicators describe the physical integrity of Lake Erie and its condition?

-Shoreline hardening (sediment transport, habitat loss, extent of development, coastal processes, connectivity)- scale? (Watershed level, including river banks, tributary, river mouth, shoreline)
-Altered flow regime (capturing channel stability)
-Kilometers of regulated river (and where located)
-Availability of spawning substrate and for rearing (nursery habitat)
-Fragmentation index (wetland and forest habitats-terrestrial) (pathway corridor)
-Community infrastructure assessment (indicative of biological condition)
-Percentage of type of cover (degree of hardness and softness)
-Water consumption, withdrawals, diversions, agriculture, industrial evaporation (expressed as for example: tiles/ km (or as a %), number of pipes, drainage ditches, open water : dry land)
-Channel alteration
-Soil type (filtration capacity)→ infiltration rate (time scale)
-Secchi readings/ water transparency
-Habitat supply-product of quantity and quality (for a range of indicator species)
-Aquatic substrate size
-Mixing offshore of a river mouth
-Beach erosion (measurement of sediment availability)
-Social indicators (users)
-Surface temperature
-Sedimentation rates (coring)

5. How do we integrate physical integrity into landscape/watershed assessments (tool availability/development)?

6. What are the data/information needs/gaps necessary to develop and implement these indicators?

Other Comments
Changes to Draft Report
→Hg is stated to be "problematic" in the report from a source of atmospheric deposition. This should be changed to mixed sources.